

**WHAT IS CLAIMED IS:**

1           1.       A cardiopulmonary bypass catheter system for arresting a patient's heart and  
2       maintaining arterial circulation comprising:  
3               a return cannula having an elongated cannula body, a distal end adapted for  
4       positioning in a blood vessel, a proximal end, a return lumen in the cannula body adapted for  
5       flowing blood therethrough, a return outlet at the distal end in communication with the return  
6       lumen, a return inlet at the proximal end in communication with the return lumen, a catheter  
7       port at the proximal end in communication with the return lumen and adapted to removably  
8       receive a catheter therein, and a hemostasis valve in the catheter port adapted to seal around a  
9       catheter positioned in the catheter port; and  
10           an occlusion catheter slidably and removably positioned through the catheter port and  
11       the return lumen, the occlusion catheter having an infusion lumen with an infusion inlet and  
12       an infusion outlet, the infusion inlet being adapted for connection to a source of cardioplegic  
13       fluid, and an expandable occlusion member proximal to the infusion outlet having a collapsed  
14       configuration adapted for introduction through the return lumen and an expanded  
15       configuration adapted for occlusion of the ascending aorta between the coronary ostia and the  
16       brachiocephalic artery;  
17           wherein the return lumen is adapted to deliver blood when the occlusion catheter is  
18       positioned therein at a flow rate sufficient to maintain arterial circulation with the heart  
19       arrested.

1           2.       The cardiopulmonary bypass catheter system of claim 1 further comprising a  
2       venting port in communication with the infusion lumen, the venting port being adapted for  
3       connection to a pump for withdrawing fluids from the ascending aorta through the infusion  
4       lumen.

1           3.       The cardiopulmonary bypass catheter system of claim 1 wherein the return  
2       lumen is adapted to deliver blood at a flow rate of at least about 4 l/min and a pressure of less  
3       than about 250 mm Hg.

1 4. The cardiopulmonary bypass catheter system of claim 1 wherein the return  
2 lumen has an inner diameter of about 5-9mm.

1 5. The cardiopulmonary bypass catheter system of claim 4 wherein the occlusion  
2 catheter has an outer diameter of about 2-5mm.

1 6. The cardiopulmonary bypass catheter system of claim 1 further comprising a  
2 source of cardioplegic fluid coupled to the infusion port.

1 7. The cardiopulmonary bypass catheter system of claim 1 further comprising a  
2 source of oxygenated blood coupled to the infusion port.

1 8. The cardiopulmonary bypass catheter system of claim 1 further comprising a  
2 pump coupled to the return inlet adapted for pumping oxygenated blood through the return  
3 lumen.

1 9. The cardiopulmonary bypass catheter system of claim 8 wherein the pump is  
2 adapted to pump oxygenated blood through the return lumen at a rate of at least about 4 l/min.  
3 at a pressure of less than about 250 mm Hg with the occlusion catheter positioned in the  
4 return lumen.

1 10. The cardiopulmonary bypass catheter system of claim 1 wherein the infusion  
2 lumen is configured to deliver cardioplegic fluid at a rate of at least 250 ml/min at a pressure  
3 of less than about 300 mm Hg.

1 11. The cardiopulmonary bypass catheter system of claim 10 wherein the infusion  
2 lumen has a cross-sectional area of at least about 4.5 mm<sup>2</sup>.

1 12. The cardiopulmonary bypass catheter system of claim 1 further comprising a  
2 venous cannula positionable in a vein and an oxygenator fluidly coupled to the venous  
3 cannula, the oxygenator being fluidly coupled to the return inlet.

1 13. The cardiopulmonary bypass catheter system of claim 1 wherein the return  
2 cannula is positionable in a femoral artery and the occlusion catheter has a length of at least  
3 about 80 cm such that the occlusion member is positionable in the ascending aorta.

1 14. The cardiopulmonary bypass catheter system of claim 1 wherein the occlusion  
2 catheter has a pre-shaped distal portion configured to conform to at least a portion of the  
3 aortic arch.

1 15. The cardiopulmonary bypass catheter system of claim 1 wherein the occlusion  
2 catheter has a pressure lumen with a pressure outlet distal to the occlusion member and a  
3 pressure port proximal to the occlusion member adapted for connection to a pressure  
4 monitoring device.

1 16. A cardiopulmonary bypass catheter system for arresting a patient's heart and  
2 maintaining arterial circulation comprising:  
3 a return cannula having an elongated cannula body, a distal end adapted for  
4 positioning in a blood vessel, a proximal end, a return lumen in the cannula body adapted for  
5 flowing blood therethrough, a return outlet at the distal end in communication with the return  
6 lumen, a return inlet at the proximal end in communication with the return lumen, a catheter  
7 port at the proximal end in communication with the return lumen and adapted to removably  
8 receive a catheter therein, and a hemostasis valve in the catheter port adapted to seal around a  
9 catheter positioned in the catheter port;

10 an occlusion catheter slidably and removably positioned through the catheter port and  
11 the return lumen, the occlusion catheter having an infusion lumen with an infusion inlet and  
12 an infusion outlet, a venting port in communication with the infusion lumen, and an  
13 expandable occlusion member proximal to the infusion outlet having a collapsed  
14 configuration adapted for introduction through the return lumen and an expanded  
15 configuration adapted for occlusion of the ascending aorta between the coronary ostia and the  
16 brachiocephalic artery;

17 a return pump coupled to the return inlet and adapted for pumping oxygenated blood  
18 through the return lumen with the occlusion catheter positioned therein at a flow rate  
19 sufficient to maintain arterial circulation with the heart arrested;

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a source of cardioplegic fluid coupled to the infusion port; and

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a venting pump coupled to the venting port for withdrawing fluids from the ascending

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aorta through the infusion lumen.

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